

REMARKS

STATUS OF THE CLAIMS

Claims 1, 3, 5, 9-15, 17-27, 29-40, 42-46, and 48-57 are currently pending.

Claim 1 has been amended.

No new matter has been added.

1. Rejection of Claims 1-57 Based on 35 U.S.C. § 112, First Paragraph

Claims 1, 3, 5, 9-15, 17-27, 29-40, 42-46, and 48-57 stand rejected as allegedly containing new matter. In response, Applicants have amended claim 1 by replacing " $0.1 \leq n < 2$ " with " $0 \leq n < 2$ ," which is fully supported by the specification as filed. In light of this amendment, Applicants submit that this rejection is moot, and they request that it be withdrawn.

2. Rejection of Claims 1, 3, 5, 9-15, 17-27, 29-40, 42-46, and 48-57 based on 35 U.S.C. § 102(b)

Claims 1, 3, 5, 9-15, 17-27, 29-40, 42-46, and 48-57 stand rejected as allegedly being anticipated by Gessell (US 4,496,660) and Garoff (WO 01/55230). Applicants respectfully disagree.

A) Gessell (US 4,496,660)

As a preliminary matter, Applicants note that there appears to be a misunderstanding of the arguments made in our prior response. Previously, we argued that "...there is no disclosure of the support...". As Gesell generally deals with a catalyst support, naturally, the

above statement has not meant that there is no support at all, but it is meant that the support - or whatever solid material - is not described in detail. This means, there is no disclosure of any ratio of Mg/Al.

With respect to Example 22 of Gessell, Applicants submit that it is different than the method of currently pending claim. The Patent Office has pointed out that Applicants have argued that it is not known what happens during hexane treatment. However, it has been emphasized that the solid material is re-slurried with hexane (cf. column 25, line 34 of Gessell). During this procedure ROH and other hydrocarbon soluble reaction products are removed (ROH has been used in excess (275 millimoles compared to 50 millimoles Mg compound and 25 millimoles Al compound)). After that, the remaining solid material was again slurried with hexane and mixed with an excess of  $TiCl_4$  as well as diethylaluminum chloride. Thus, the support material was not analyzed before the addition of  $TiCl_4$  and the aluminum compound - the composition of the support material is unknown, i.e. the amount of it is unknown as well as the Mg/Al ratio. Therefore, it is not known what happens exactly during the hexane treatment.

Further, in Gessell, the diethylaluminum chloride is added to the support/ $TiCl_4$  mixture in order to insert a reducing agent (cf. column 12, lines 36-56). This is not necessary in the present application, i.e. the support material according to claim 1 can be treated with

TiCl<sub>4</sub> without using any reducing agent. The obtained support material has reducing power as such, which is not the case with the support material of Example 22 of Gesell. Therefore, no excess of environmentally hazardous (and expensive) TiCl<sub>4</sub> is needed to achieve the same result. Support for this can be taken from Table 3 of the present invention, wherein it is shown that about 50% of the Ti is reduced without the addition of an additional reducing agent. Thus, the support material of the present invention and that of Gesell must be different because they have different properties. Consequently, the currently claimed method must differ from that of Gesell.

Moreover, there are further fundamental differences between the support material of the present invention and that of Gesell (Example 22). In the present invention, a solid reaction product is obtained by the addition of the magnesium compound to the aluminium compound. In Example 22 of Gesell, these compounds are dissolved in the same solution (hexane, the same solvent as used in the present application; cf. column 25, lines 25-31 of Gesell and page 13, lines 1-9 and the Examples of the present application). To form a solid reaction product, an extra halide source is needed (cf. column 25, lines 29-34). Thus, there is a fundamental difference in the preparation process of the present invention and that of Gesell.

Applicants wish to further emphasize that the addition order of the components as given in claim 1 is of great relevance, contrary to

the statement of the Patent Office. The statement by the Patent Office has been made without citing any evidence that the addition order in a chemical reaction can be disregarded. It is the Examiner who has to prove that the same result would be achieved with another addition order. Just to show a simple example: there is a big difference between the addition of water to a concentrated acid and the addition of said concentrated acid to water. Thus, the addition order of a chemical reaction is always crucial with respect to the result to be achieved (see further comments below for Garoff and Vereecke).

Additionally, in the present invention, an aluminium halide compound is always used ( $\text{Al}(\text{R}_1)_y\text{Cl}_{3-y}$ ;  $y < 3$ ); in contrast, Example 22 of Gesell uses an alkyl aluminium compound with no halogen (triisobutylaluminum). Thus, the above mentioned additional halide source is needed.

Furthermore, the washing step in Example 22 of Gesell (re-slurrying and decanting step), although repeated twice, is not done to adjust the Al/Mg ratio. Neither Example 22 nor the specification suggests or even hints at adjusting the Al/Mg ratio by the washing step. This is in contrast to the present application.

Finally, the catalyst support and thus the final catalyst of the present invention have a superior morphology such as a desirable particle size and a narrow particle size distribution.

In light of the above, Applicants submit that the Gesell reference does not anticipate the currently pending claims. Consequently, reconsideration and withdrawal of the anticipation rejection based on Gesell is requested.

B) Garoff (WO 01/55230)

In the final office action, the Patent Office refers to Example 2 of Garoff (which is from the same Applicant) and alleges that this example shows that there is no difference between the addition order of Mg and Al compounds to obtain the same support material. However, this is not the case. The target of Garoff was to find soluble Mg complexes, which could be impregnated on separate solid support materials (e.g. silica) when dissolved in a solvent in order to get the desired properties (cf. page 3, lines 11-21).

In example 2 of Garoff, the Mg compound is different from the Mg compound used in the present invention. As can be taken from example 2, the Mg compound is  $Mg(OR')_2 \bullet R'OH$ , i.e. it contains an extra alcohol group due to the 3:1 ratio of alcohol and originally used Mg compound (cf. page 16, lines 4-7 and 14). This compound is then reacted with ethyl aluminium dichloride, whereupon some precipitation, which is more a "gel like" formation and not at all a clear solid particulate support, can be formed. The precipitation can be prevented by using toluene. In contrast, in the present application, the Mg compound

does not contain any additional R'OH (cf. formula (I) of claim 1), nor is the resulting Mg-Al complex soluble in the solvents used.

Applicants concede that the same solvent is used in Example 2 of Garoff and in the present invention (cf. page 13, lines 1-9 of the present invention - aliphatic or aromatic C<sub>5-20</sub> hydrocarbons (e.g. toluene) is used). However, different results are obtained. In the present application, a solid support precipitates upon addition of the Mg compound to the Al compound, whereas in Garoff, no precipitation forms; rather, everything stays in solution.

Further evidence that the order of addition is important can be found in the following. In Example 3 of Garoff, the Mg-ROH ratio in the Mg compound preparation corresponds to that in the present invention and thus, at this point, the Mg solution of Garoff is the same as in the present invention. In Garoff, the Al solution was added to the Mg solution, and no precipitate forms. In the current invention, the order of addition is switched, i.e., the Mg solution is added to the Al solution, and a precipitate forms. This clearly shows that the addition order has an essential effect on the final product (solid vs. soluble), with directly contravenes the Patent Office's position..

And finally, Garoff is totally silent with respect to the washing of any solid support material to adjust the Mg/Al ratio.

In light of the above, Applicants submit that the Garoff reference does not anticipate the currently pending claims. Consequently, reconsideration and withdrawal of the anticipation rejection based on Garoff is requested.

4. Rejection of Claims 1-57 Based on 35 U.S.C. § 102(b) in view of U.S. Patent 4,496,660 (Gessell et al.)

Claims 1-57 have been rejected for allegedly being anticipated by U.S. Patent 4,496,660 (Gessell et al.). In particular, the Office asserts that the invention as claimed is disclosed in Example 22 and Claims 13 and 21 of Gessell. The Applicants respectfully disagree.

In Example 22, 275 mmol ROH is added to a mixture of 50 mmol  $Mg(Bu)_2$  + 25 mmol  $Al(i-Bu)_3$  (alcohol is used in excess). As a result, 50 mmol  $Mg(OR)_2$  + 25 mmol  $Al(OR)_3$  ("compound A") and 100 mmol ROH (excess) is obtained. The obtained compound A is chlorinated with  $SiCl_4$  (compound B), wherein the OR groups on Mg are replaced by Cl. Some solid material is obtained, which is re-slurried with hexane. During this procedure, ROH is removed. The obtained product contains at least the components  $MgCl_2$  and  $Al(OR)_3$ , but there is no disclosure of the support, as is encompassed by the currently pending claims. It is not known what happens during the hexane treatment, for example, whether other components are removed or to what extent.

In contrast to Example 22 in Gessell, the particulate catalyst support of the present invention is prepared in a unique fashion. First, the solution of a magnesium compound is added to the solution of the aluminum compound, whereupon precipitation occurs. The

addition order is of great relevance and importance as the addition of the magnesium to the aluminum leads to the particulate support with the desired morphology. As stated previously, in Example 22 in Gessell, both the magnesium and aluminum compounds are provided in the reaction vessel, and then an alcohol is added (in large excess), followed by dropwise addition of  $\text{SiCl}_4$ . Precipitation occurs only upon addition of  $\text{SiCl}_4$ , and not before.

Second, according to the present invention, the desired morphology and Mg:Al ratio of the catalyst support are obtained by a controlled washing step. The support is clearly recovered and washed prior to its use as a carrier material for catalyst preparation.

In light of the above arguments and claim amendments, Applicants submit that the currently pending claims present amendments to the claims limiting their scope to only aluminum-containing supports and further incorporation of the limitations of cancelled claims 2, 4, 6, and 8, the present claims are not anticipated by Gessell. Therefore, they respectfully request reconsideration and withdrawal of the 35 U.S.C. § 102(b) rejection based on U.S. Patent 4,496,660.

5. Rejection of Claims 1-57 Based on 35 U.S.C. § 102(b) in view of WO 01/55203 (Garoff et al.)

Claims 1-57 have been rejected for allegedly being anticipated by WO 01/55203 (Garoff et al.). In particular, the Office asserts that the invention as claimed is disclosed in Examples 2, 3, and 6 of Garoff. The Applicants respectfully disagree.

In Examples 2 and 3, Garoff describes a process for the preparation of a catalyst where an aluminum compound (ethyl aluminum dichloride) is added to the reaction product of a magnesium compound (BOMAG-A) and an alcohol (2-ethyl-hexanol).

However, as previously discussed with respect to Gessell, there are fundamental differences between the process of the present application and the process described in Garoff. In Garoff, the chemicals are added in such an order that a solid support material is never formed by the chemicals themselves. This is done by adding the chlorinating  $\text{EtAlCl}_2$  dropwise to the  $\text{Mg}(\text{OR})_2$  solution. Addition of reagents in the order of Garoff prevents the situation where  $\text{Mg}(\text{OR})_2$  meets an excess of  $\text{EtAlCl}_2$ , to initiate precipitation. This can be expressed as:

Present application:  $\text{Mg}(\text{OR})_2$  added to  $\text{EtAlCl}_2$  -> Precipitation.

Garoff:  $\text{EtAlCl}_2$  added to  $\text{Mg}(\text{OR})_2$  -> Soluble complex.

Consequently, Garoff (Example 4 and 5) utilizes silica as a support material for the soluble complex to provide a specific morphology to the catalyst (which is not provided in Examples 2 and 3).

In Example 6, no silica support is used, and a soluble complex is created consisting of all the catalyst components using the addition order technique as described above. The liquid catalyst complex solution is added as such directly into the polymerization reactor together with the co-catalyst. As such, no suitable catalyst morphology can be achieved utilizing this technique, and the polymer

morphology reflects a corresponding disorder. In practice, it can be expected that the free  $TiCl_4$  reacts with the co-catalyst and precipitates as  $TiCl_3$ , which, in turn, affects the particle size and the particle size distribution of the polymer.

In contrast, the present application describes a support synthesis that uses the reverse addition order to create an ordered precipitation reaction. By adjusting the wash conditions of the precipitate (see, Table 1 of the application as filed), the reduction power of the support material can be adjusted to a desired level.

Further, Garoff is silent with respect to the adjustment of the molar ratio of Al to Mg and obtaining the desired morphology (particularly via a controlled washing step). In the present application, the support is clearly recovered and washed prior to its use as a carrier material for the catalyst preparation. Garoff does not disclose any washing step to adjust the molar ratio of the particulate support, even in examples 4 and 5 where a carrier (silica) is used.

In view of above arguments and claim amendments, Applicants submit that the currently pending claims are novel. As such, they respectfully request reconsideration and withdrawal of the 35 U.S.C. § 102(b) rejection based on the Garoff reference.

3. Rejection of 1, 3, 5, 9-15, 17-27, 29-40, 42-46, and 48-57 Based on 35 U.S.C. § 103(a) in view of WO 99/55741 (Vereecke et al.)

Claims 1, 3, 5, 9-15, 17-27, 29-40, 42-46, and 48-57 stand rejected for allegedly being obvious in view of WO 99/55741 (Vereecke et al.). Applicants respectfully disagree.

The Patent Office is of the opinion that it would be obvious to change the parameters and the addition order in order to achieve the claimed invention. As already explained above, the addition order is of great relevance to any chemical reaction and in particular in the preparation method of the present invention. This fact can be taken from many passages in Vereecke itself. For example, on page 5, 2<sup>nd</sup> paragraph it is stated that "*a catalyst of poor morphology is obtained if the mixing is performed without appropriate control, for example where a solution of the dialkyl magnesium compound is added to excess chlorinating agent (i.e. in the reverse order)*". Applicants submit that the Patent Office's interpretation of this paragraph is not correct. One skilled in the art will recognize that this paragraph teaches that the addition of the Mg compound to an excess of the Al compound is to be avoided. Even under vigorous stirring and careful dropwise addition, the Mg compound is still added to a huge excess of the Al compound, which leads to undesired solid material. With such an addition order a controlled precipitation as stated by the Patent Office is not possible.

The above is also confirmed by Comparative Example 3 on page 10 and 11 of Vereecke. There it is stated that the reverse addition order, which has been used in this Example, is 1) not suitable for the

production of a catalyst with a narrow particle size distribution and 2) produces a high amount of fines. Therefore, the skilled man looking for a method to produce a catalyst support with improved morphology and a narrow particle size distribution (cf. page 4, line 24 to page 4, line 9 of the present application) would no find any hint in Vereecke which would lead to the method of the present invention. Instead, Vereecke clearly teaches away from the method as claimed in the present application

Further, contrary to the statement by the Patent Office, the starting compounds in Vereecke and the present invention are different. In Vereecke the starting Mg compound is  $MgR_1R_2$  (wherein  $R_1$  and  $R_2$  are independently a  $C_1$  to  $C_{10}$  alkyl group, i.e. dialkyl magnesium), whereas in the present invention the Mg compound always contains some OR groups ( $Mg(OR_1)_{2-n-x}(R_1)_nX_x$ ;  $0 \leq n < 2$ ; n is never 2, i.e. "2-n-x" can never be 0). It should be also mentioned that in Vereecke the Mg compound is not reacted with any alcohol to form a dialkoxy magnesium compound as in the present invention. In Vereecke an alcohol is reacted with the chlorinating Al compound forming  $(R^3O)_nAlCl_{3-n}$ . Comparative Example 1 clearly indicates that the alcohol is important for the reactivity of the chlorinating agent and not to form any dialkoxy magnesium compound. Further, the Al compound in Vereecke also differs from that of the present invention ( $Al(R_1)_yY_{3-y}$ ;  $R_1$  is a  $C_{1-20}$  hydrocarbyl group).

Finally, in the present invention, the support material is desired to have reducing power. This is achieved by the specific method as claimed in claim 1, wherein the defined starting compounds are contacted with each other in the specific addition order and the resulting support material is washed in a controlled way to adjust the Mg/Al ratio to a desired level. The reducing activity is clearly shown in Table 3 (see also explanations above). In Vereecke the obtained MgCl<sub>2</sub> support is washed several times to insure that any reducing activity is washed away (cf. paragraph bridging pages 5 and 6, Example 1). This is also contrary to the method of the present invention.

The Applicants submit that in light of the above, the currently pending claims are not obvious. Consequently, reconsideration and withdrawal of the rejection based on 35 U.S.C. §103(a) is requested.

CONCLUSION

Applicants respectfully contend that all requirements of patentability have been met. Allowance of the claims and passage of the case to issue are therefore respectfully solicited.

Should the Examiner believe a discussion of this matter would be helpful, he is invited to telephone the undersigned at (312) 913-2114.

Respectfully submitted,

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